United States," prepared by Drs. Wood and Bache, two of the Presidents of the Society. The progress during the last two centuries, not only of Botany and Mineralogy and other sources of the Materia Medica, but of the general methods of science, is remarkably illustrated by a comparison of the two books.

Pending nomination No. 494 was read:

And the Society was adjourned.

Stated Meeting, May 15, 1863.

Present, seventeen members.

Dr. Wood, President, in the chair.

Letters accepting membership were received from William Dwight Whitney, dated New Haven, April 21st; from E. A. Washburne, dated Philadelphia, May 2d; and from James Pollock, dated Philadelphia, May 14th, 1863.

Letters to the Librarian, inclosing photographs of the writers, were read, from B. Silliman, Sr., of New Haven, Josiah Quincy, of Boston, and Gen. Swift, of Geneseo, in the State of New York.

Donations for the Library were announced from the Essex Institute, the Museum of Comparative Zoology, in Boston; the American Journal of Science and Art, Blanchard & Lea, and Dr. Parrish, of Philadelphia; Professor J. H. Alexander, of Baltimore, and the Academy of Sciences in St. Louis.

Mr. Dubois communicated the following remarks on assay-balances:

The recent receipt of two assay-beams at the Mint, procured for the use of Dr. Munson, assayer of the new branch Mint at Denver, in the Territory of Colorado, furnishes occasion for a few remarks on the progress of this delicate branch of art.

Thirty-one years ago, when Mr. Eckfeldt, the present assayer of the Mint, entered upon that office, he found that the beam on which all his operations were to turn, would not itself turn with a less weight than about the one-fiftieth part of a grain. Consequently, the nearest report of the fineness of gold was by gradations of one thirty-second ($\frac{1}{32}$) part of a carat, which was about $1\frac{3}{10}$ thousandths, according to the present notation. The reports of the British assayers were not in those days more exact, whatever their apparatus might have been.

About three years later, Mr. Peale brought from Paris, for the use of the Mint, a beam of superior finish and much greater delicacy; in which, among other improvements, stirrups were substituted for silk cords, although there was still a cord for lifting.

Two years farther on, we had Mr. Saxton restored from England to his own country, and employed in the Mint in this branch of art, in which he had already become famous. Various decided improvements were introduced by him, in the beams made for the Mint and Branch Mints.

After this artist had been claimed by Prof. A. D. Bache, for the Bureau of Weights and Measures, and was transferred to Washington, our assay department had recourse to the manufactory of Oertling, in London. His beams, although rather complicated, and of many parts, are admirable for delicacy and beauty, and for a combination of the most desirable qualities.

The establishment of the Branch Mint, already referred to, made a fresh call for assay balances. We were about to resort to the last-named maker, when Dr. Torrey, of the United States Assay Office at New York, made a favorable mention of the manufactory of Becker & Son, at Brooklyn, from his own experience of what they could do. Any less authority would perhaps have been held insufficient, on the narrow but venerable principle of questioning whether "any good thing can come out of Nazareth." The order was consequently given by Gov. Pollock, Director of the Mint; and in a very short time two balances, with sets of weights, were made and delivered at the Mint.

It is not at all the purpose of this notice to enter into a detailed description of the parts and peculiarities of the different kinds of assay-beams. There is nothing like an actual inspection of them, to give a just idea of their merits; and persons who take a special interest, can easily have the opportunity. Suffice it to say, that this instrument compares favorably with any other, in respect to delicacy, philosophic propriety, good taste, and fine finish. In respect to simplicity and stability, two very important features, it may be said to excel.

There is one point of considerable account, in regard to this beam,—that its cost is about one-third of the London make, namely, seventy-five dollars against two hundred and twenty-five, counting the present cost of a bill of exchange. It is difficult to understand how the Messrs. Becker can do justice to themselves, at such a price. And not only was there a saving of money, but of time also.

There is one other point worthy of a few words,—that we have here a further development of the progress of delicate workmanship in our own country. We proceed from clocks to watches, from reapers to penknives. And in regard to philosophical apparatus, if we may introduce names, it is well known that our Ritchie, at Boston, has so improved upon Ruhmkorff, of Paris, in the powerful induction-coil (the most splendid instrument of the day), as to entitle it to be called by his own name, and to be counted *American.*

It should be stated, that the balance will indicate the tenth of a thousandth of the demi-gramme, which is our normal weight in the gold assay; that is, it will turn with $\frac{1}{1300}$th part of a grain. As the beam and appendages are quite heavy, and capable of bearing twenty times the largest weight ordinarily used, it might be made much more sensitive by lightening the parts; but for working purposes, this is not desirable. Such a sensibility would serve to gratify curiosity, or to make a boast of, but would not be in keeping with the amount of deviation which is to be expected in other parts of the assay—the cupellation and parting. It would be too much like the exquisite refinement of some who report specific gravities: their apparatus carries them safely to the second decimal, but their arithmetic extends to the fourth or fifth.

Dr. Wood made a verbal communication respecting Mr. Harrison's steam boiler.

Dr. Dawson's communication on the Coal of Nova Scotia was read.

Mr. Robert Briggs of Philadelphia, communicated through the Secretary, extracts from a private professional statement of his views of the true seat of reserved power in rolling-mill machinery, and of the importance of using boilers of the largest possible *water* capacity, for accumulating and storing up the force to be expended, at intervals, with great rapidity, in the passing of the iron through the rolls.

Firstly. It is clear that in an extended mill, the waste heat of the furnaces is far in excess of what is required to supply steam for working the iron; and that in some way the heat is, by the many boilers, available when wanted. When working out one furnace, several others are supplying heat, more or less; and yet each furnace, in a day's work, only furnishes what suffices for itself. Consequently, the question resolves itself, in this case, into,—how can you so store up heat (or power) that your three or four furnaces should be upon the same ground with three or four out of twelve or twenty?

I will consider the store-rooms of power you have. Take your fly-wheel. I assume that to be 18 feet diameter, and to weigh 32,000 pounds; then assuming the diameter of centre of rotary mass to be 16 feet, and the number of revolutions per minute, &c., as follows:

65 rev. per min. gives a vel'y per sec., with 16 ft. diam, = 54.5 ft.
50 " " " " " " " " = 41.9 ft.

Now if you consider how far a body must fall to have these velocities, ($V^2 = 64.3$ h.)

When $V = 54.5 \therefore h. = 46.2$ ft. $\times$ 32,000 lbs. = 1,478,400 ft. lbs.
$V = 41.9 \therefore h. = 27.5$ ft. $\times$ 32,000 lbs. = 880,000 " "

Difference, 598,400 " "

In other words, if the weight of the fly-wheel were permitted to fall from the heights of 46.2 and 27.5 feet, the same velocities would have been attained that 65 and 50 revolutions per minute gives, and the mechanical work given out by slowing the fly-wheel (from 65 to 50 revolutions) is 600,000 ft. lbs. (very nearly.)

Suppose this slowing to take place while rolling a long thin plate, which would be $\frac{1}{30}$th of a minute in passing the rolls. (That is taking the mean velocity assumed of $\frac{65+50}{2} = 57\frac{1}{2}$ revolutions per minute, and taking the rolls at 18 inches diameter or 4 feet $8\frac{1}{2}$ inches circumference, then the speed of the periphery of the rolls is 260 feet per minute; whence, in $\frac{1}{30}$th minute a plate $8\frac{2}{3}$ feet long would pass the rolls.) Then the fly-wheel will have developed a force represented by 600,000 $\times$ 30 ft. lbs. for one minute, or 18,000,000 lbs. in one minute, equal to $\frac{18,000,000}{33,000} = 544$ horse-power, *whilst the force lasts.*

Or, in other words, the fly-wheel will have performed the work which a 540 h. p. engine would have been needed to do. On the other hand, to restore the speed of the fly-wheel in *half a minute,* would only take at the rate of 1,200,000 ft. lbs. per minute, or the work of a 36 h. p. engine. These calculations show that the force of the fly-wheel is only available for the exigency of part of a minute, and not as a store of force in working out a heat.

Admitting that we cannot rely upon the making of steam on the instant of rolling, as sufficient for working out the heat (even when we consider the waste-heat of your four furnaces to be employed in the formation at the time of rolling), what is the next source of force?

The following figures will demonstrate that the quantity of heated water in the boilers must supply the deficiency.

Suppose the blow-off point of the boilers to be 85 lbs., suppose the minimum working pressure of steam (to insure the proper acceleration of the fly-wheel between the passes) to be 60 lbs., then I estimate (somewhat approximately) as follows:

Pressure.	Temperature.	Volume of steam per lb. of water.	Weight of cub. ft. of water at 318°.
85	328°	4.2 cub. ft.	56.7 lbs.
60	307°	5.8 " "	

56.7 lbs. at $\overline{21^\circ} = 1191^\circ$, div. by lat. heat of water at 60 lbs. $\overline{900^\circ}$

Giving $1\frac{32}{100}$ths lbs. of water transformed to steam (or $7\frac{1}{2}$ cub. ft. of 60 lbs. steam made) out of each cub. ft. of water in the boiler.

Suppose the governor to regulate so that 60 lbs. is the highest pressure which enters the cylinder, then each cub. ft. of steam the boilers may hold at 85 lbs. will have supplied $\frac{58}{42} = 1.38$ cub. ft. of steam to the engine. Showing that as a store of power, water contents are about five times as valuable as steam contents in the boilers.

The above indicates the ground on which is based the English practice of elephant boilers; and aside from the consideration of safety from abundance of water, and of ease of getting at the interior, to remove scale or sediment, it still further demonstrates the propriety of the objection I urged, to the abstraction of water-space by flues or tubes, in rolling-mill practice. . . . .

Secondly. To get the largest result (for combustion of coal under boilers), there is used, in tubular boilers of the best type, 3 feet of surface for each pound of coal burnt per hour.

For mill practice, with cylinder boilers, about 18 feet of surface per square foot of grate is used.

If I had but few furnaces, I should prefer to increase this to about 24 feet of surface (or even 30) per square foot of grate. This is from 270 to 337 feet of surface for each of the grates under present consideration. . . . .

Were I limited for room, so that long cylinder boilers were impracticable, I would advise the use of French boilers in place of flue boilers. I am satisfied the French universal practice, of putting the flues outside, is superior to ours, of putting them inside, in similar cases.

. . . . I do not wish you to assume, from all this, that I look upon a well-built two-flued boiler as seriously objectionable in a mill, only that I prefer the *same extent of surface*, with greater capacity of water, in a cylindrical form.

Mr. Chase paid a tribute to the genius and merits of M. Des Guignes, as an orientalist and etymologist, having an insight into the true relationships of the languages and histories of the east and west of Asia not sufficiently acknowledged or appreciated.

Philologists are peculiarly exposed to pert and arrogant criticism. Their favorite studies lead them into unexplored fields, and among the many hypotheses that they are obliged to hazard in their endeavors to explain the laws and phenomena of language, it is reasonable to expect that some will be overthrown by subsequent investigation. It then becomes an easy matter for sciolists to talk of seeming and fanciful resemblances, and thus throw discredit on the whole science of Etymology, while they gain a cheaply bought reputation for critical acumen. It is therefore particularly gratifying to find that many of the shrewd surmises of a true scholar, like M. de Guignes, after enduring the unstinted ridicule of his contemporaries, are confirmed by the discoveries of a later generation.

To Zoega the credit is generally given, of first forming the happy conjecture that several of the Egyptian hieroglyphs were employed merely as phonetic or alphabetic characters. But more than thirty years before he announced his views, he had been anticipated by M. de Guignes, who, in the very Memoirs that were most mercilessly criticized, not only declared his belief in the phonetic use of most of the Egyptian hieroglyphs, but also, arguing from the supposed common origin of the Chinese and Egyptian systems of writing, he surmised that the cartouches contained royal names and titles, and that the Egyptian, as well as the Chinese characters, might all be grouped under the three classes of ideographs, determinatives, and phonetics.

These three conjectures, as well as some others of minor importance, have been most completely and satisfactorily substantiated by the discoveries of the modern English, French, and German Egyptologists. In one important particular, the analogy between the two systems appears to be even closer than M. de Guignes anticipated. He considered the use of phonetics in Chinese to be more infrequent and imperfect than in Egyptian, but the conclusions of Bunsen in regard to syllabic hieroglyphs, and Sharpe's groupings of supposed hieroglyphic equivalents, render it probable that the resemblance was carried out into the minutest details,—even to the occasional employment of final characters to represent the final sounds of a word, as well as of initial characters to represent the initial sounds.

Sir Wm. Jones early announced his reasons for believing in a common origin of the Chinese, Egyptian, Shemitic, and Aryan types of civilization, and many other eminent antiquarians and ethnologists have been led by different paths to the same conclusion. My own studies have tended at nearly every step to impress me with a similar belief, and I hope at some future meeting to lay before the Society some farther results of my own investigations, as well as some confirmations of the most important hypotheses of M. de Guignes. To him will ever belong the honor, of having been one of the first to suggest that the evidences of a common origin are still traceable in the records of two of the oldest known forms of civilization, and though he may have erred in supposing that the relation of China to Egypt was filial, rather than fraternal, the error was natural, excusable, and comparatively unimportant.

Mr. Lesley, at the request of the members present at the meeting of the Board of Officers, gave a verbal narrative of the organization of the National Academy of Sciences, on the 22d–24th April, in the Chapel of the University, in the City of New York.

The Minutes of the last meeting of the Board of Officers and Members of Council were read.

Pending nomination No. 494, and new nominations Nos. 495 to 505, were read.

And the Society was adjourned.